

NEW RECORDS OF MARINE TARDIGRADES (ARTHROTARDIGRADA) FROM VICTORIA

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Three new records of marine tardigrades are described from Victorian localities. These include the first record of *Batillipes* from Victoria, the first record of *Archechiniscus* from Australian waters as well as an additional record of *Echiniscoides*. Adaptations of each of these tardigrade genera to the marine environment are discussed.

BOULENGEY, a student of the French naturalist Félix Dujardin, is credited as being the first person to observe a marine tardigrade. In August 1849 he discovered one on the side of a glass, filled with sea-water (Richters 1908). This was subsequently described as *Lydella* by Dujardin (1851) who failed to give the specimen a specific name. This was rectified by Plate (1888) who named the species *Lydella dujardini* in honour of its author. Hay (1906) erected a new genus, *Microlyda*, for this species after it was discovered that the generic name proposed by Dujardin was already occupied. No specimen of *Microlyda* has since been recovered and this taxon is now thought to represent a juvenile halechiniseid (Ramazzotti & Maueci 1982).

The first marine tardigrades to be collected from Australian waters were six specimens of *Echiniscoides sigismundi polyuesiensis* Renaud-Mornant, 1976 from Port Melbourne, mounted in 1928, and were identified in the Thulin collection by Kristensen & Hallas (1980). Renaud-Mornant (1981) reeorded *Halechiniscus remanei* Schulz, 1955 from Townsville, north Queensland, while Kristensen (1984) described *Wingstrandarctus corallinus* and recorded *Styraconyx kristenseni* Renaud-Mornant, 1981 from coralline sand from One Tree Island, Queensland.

Kristensen & Higgins (1984) reeorded *Styraconyx craticulus* (Polloek, 1983) from algae growing on intertidal barnacles from Neilsen Park, Sydney Harbour; Hastings Point, Brisbane; Caloundra, Moreton Bay and Cape Cleveland, Townsville. This paper reports three different marine tardigrades including the first Victorian reeord of the genus *Batillipes*, the first Australian reeord of the genus *Archechiniscus* and a further reeord of the genus *Echiniscoides*.

MATERIALS AND METHODS

Between 1977 and 1979, Glen Carruthers collected a number of marine tardigrades from two sites in Victoria—fine beach sand at mid and low tide levels at French Island (38°20'S, 145°20'E) and from algae growing on barnacles at San Remo (38°35'S, 145°20'E). These were mounted on microscope slides and then photographed. The material was passed on to the author for further study in the early 1990s. Unfortunately, the mounts have dried out and the resultant preservation of features is poor. Enough detail is retained however in the original photographs to confidently identify the specimens to at least generic level. No measurements were undertaken because of apparent shrinkage associated with dessication of the specimens.

Specimen collection abbreviation: ATS = Australian Tardigrade Survey.

SYSTEMATIC ZOOLOGY

Class HETEROTARDIGRADA Marcus, 1927

Order ARTHROTARDIGRADA Marcus, 1927

Family Batillipedidae Ramazzotti, 1962

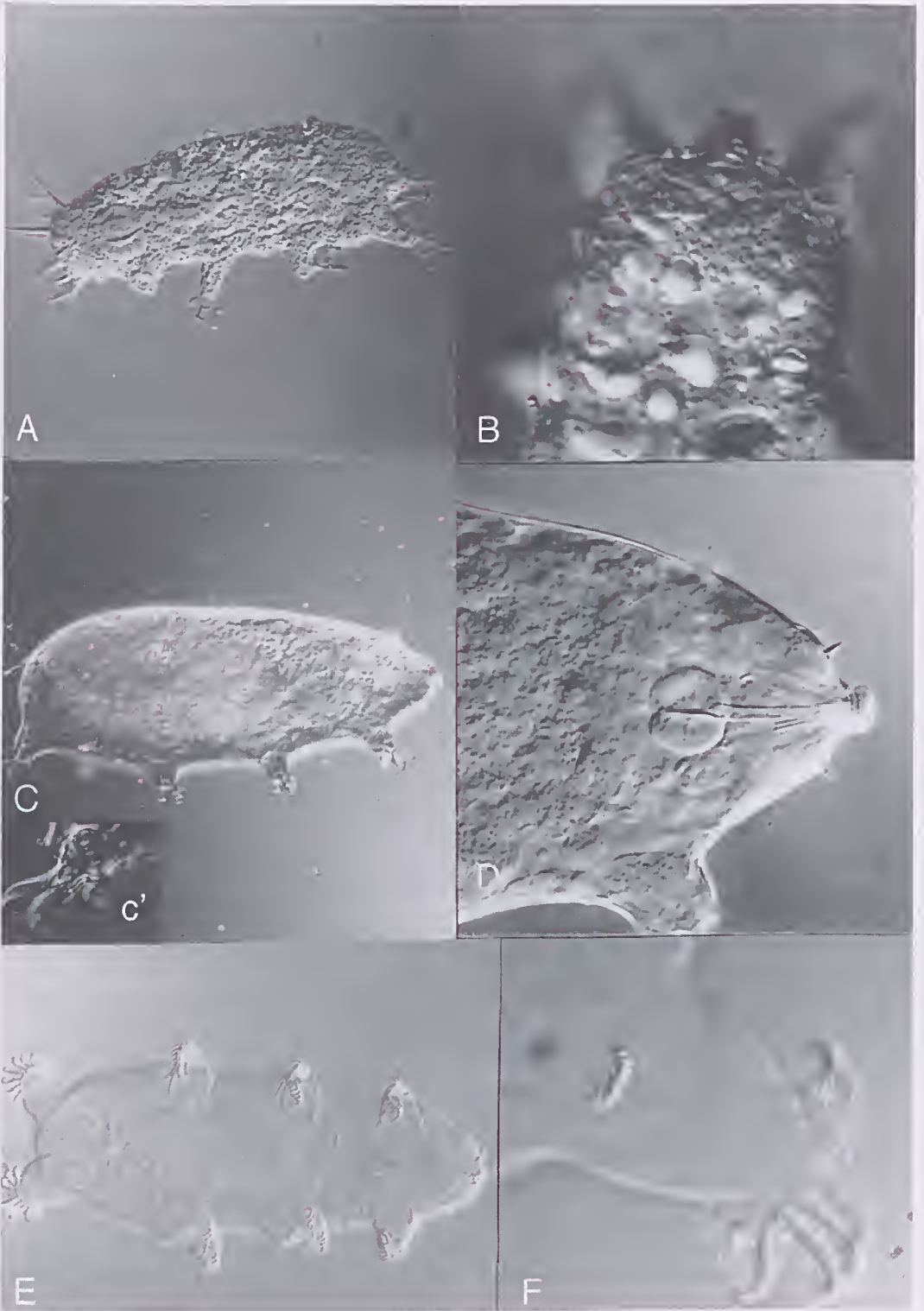
Genus *Batillipes* Richters, 1909

Type species. *B. mirus* Richters, 1909.

Batillipes sp.

Fig. 1A, B

Material. Four specimens (ATS 513/1, 3, 5, 7) collected from French Island, Victoria.



Characters. Batillipedids are diagnosed as arthro-tardigrades with median cirri present and with six toes (in adults) of different lengths with disc at terminus of the toe stalk. There are presently 23 species of *Batillipes* recognised and several (eg. *B. mirus*, *B. pennaki* and *B. phreaticus*) may have a cosmopolitan distribution. Several morphological features are used in the diagnosis of *Batillipes* species including conformation of lateral body projections and the relative length and shape of cephalic and caudal appendages. The relative lengths of toes on the fourth leg has also been used (Pollock 1970). The Victorian specimens are adult animals with six toes on each leg. There is little differentiation between the head and the body. The median cirrus is unpaired and tapered. The internal cirri have thick bases and taper rapidly, ending in a swollen tip. The external cirri are short and horn-like, also ending in a swollen tip. The primary elavae are tube shaped while the lateral cirri are long and whip-like.

The specimens have been squashed under the cover slip and the details of their toe patterns can not be reliably discerned. Their caudal appendages are bluntly bifurcated and do not match that of any known *Batillipes* and thus may represent a new species or a previously unrecorded instar of an already described species. They are therefore only identified as *Batillipes* sp.

Remarks. Species of *Batillipes* are commonly found in the interstitial spaces of sandy beaches often being the most dominant tardigrade (McKirdy 1975). Typically, one to three species dominate (Pollock 1989). The specimens described here come from an opportune collection of sand from only one location and in no way represent the probable diversity of either *Batillipes* or other marine tardigrades at that location. Further systematic collection and the examination of live specimens is needed to clarify the identity of this and other species of *Batillipes* that may be present along the Victorian coastline.

Family Halechiniscidae Thulin, 1928

Subfamily Archechiniscinae Grimaldi De Zio & D'Addabbo Gallo, 1987

Genus *Archechiniscus* Schulz, 1953

Type species. *A. marci* Schulz, 1953.

Archechiniscus cf. *A. marci* Schulz, 1953

Fig. 1C, D

Material. Two slides (ATS 513/4) collected from Tortoise Head, French Island, Victoria and (ATS 514/1) collected from algae growing on intertidal barnacles at San Remo, Victoria.

Characters. Archechiniscids have four claws with the two lateral claws directly inserted on the tarsus and internal claws supported by fingers. Internal toes have a hook-like dorsal point. Median cirrus absent. Presently there are two species recognised within the genus—*Archechiniscus marci* Schulz, 1953 and *A. minutus* Grimaldi De Zio & D'Addabbo Gallo, 1987. The Victorian specimens are identified as *Archechiniscus* cf. *A. marci* on the basis of the presence of apophyses on the placoids, the shape of the furca (non-rectangular cf. *A. minutus*) and the lack of a peduncle at the base of the external elaws.

Remarks. *Archechiniscus marci* is a cosmopolitan species with worldwide distribution. It has been found in both the Northern Hemisphere (Italy [Grimaldi De Zio et al. 1983b; D'Addabbo Gallo et al. 1987]; El Salvador [Schulz 1953]; Lesser Antilles [Renaud-Mornant & Gourbault 1984]) and Southern Hemisphere (Galápagos Islands [Schuster & Grigarić 1966]; Madagsear [Renaud-Mornant 1979a, 1979b] and New Caledonia [Renaud-Mornant 1967]). It has been associated with barnacles collected with coralline rubble but also in sand at depths of 18 metres (Renaud-Mornant 1967). The Victorian specimens have been found in both microhabitats.

Binda (1978) established the Archechiniscidae to correct the anomalous placement of *Archechiniscus* in the eutardigrade family Orecllidae based on the presence of its digitate legs. Renaud-Mornant (1979b) also expressed doubts about the inclusion of *Archechiniscus* within the Orecllidae. Kristensen & Higgins (1984) supported Binda's erection of the Archechiniscidae. Grimaldi De Zio & D'Addabbo Gallo (1987) cited affinities between *Archechiniscus* and *Styraconyx* and between

Fig. 1. A, *Batillipes* sp. (dorsolateral view); B, caudal appendage; C, *Archechiniscus* sp. lateral view; insert showing claw detail; D, pharyngeal bulb; E, *Echiniscoides sigismundi* ventral view; F, claws of fourth leg.

Archechiniscus and *Euclavarctus* as justification to transform the Archechiniscidae into a subfamily of the Halechiniscidae.

Order ECHINISCOIDEA Marcus, 1927

Family Echiniscoididae
Kristensen & Hallas, 1980

Genus *Echiniscoides* Plate, 1889
(emended Kristensen & Hallas 1980)

Type species. *E. sigismundi* (Schultze, 1865).

Echiniscoides sigismundi s.l. (Schultze, 1865)

Fig. 1E, F

Material. Two specimens (ATS 514/2, 3) collected from algae growing on intertidal barnacles at San Remo, Victoria.

Characters. Echiniscoidids have reduced cephalic appendages (cirrus A and clava) with each leg bearing more than four claws and being devoid of spurs. There are at least six species currently recognised in the genus *Echiniscoides*—*E. bruni* D'Addabbo Gallo et al., 1992; *E. higginsi* Hallas & Kristensen, 1982; *E. hoepneri* Kristensen & Hallas, 1980; *E. pollocki* Hallas & Kristensen, 1982; *E. sigismundi* (Schultze, 1865) and *E. travei* Bellido & Bertrand, 1981. The Victorian specimens were identified using keys provided in Hallas & Kristensen (1982) and Ramazzotti & Maucci (1983).

The only previous member of this genus recognised from Australia, *E. sigismundi polynesiensis* Renaud-Mornant, 1976, is diagnosed with a sculptured cuticle and central claws aberrantly bent at right angles. The specimens under study lack any visible cuticle sculpturing and have 8–10 claws. The Victorian specimens most closely resemble *E. sigismundi sigismundi* which occurs along the European coast from Norway and Sweden to northern France (Hallas & Kristensen 1982). There is also a report of this subspecies from Tenerife Island (Ramazzotti & Maucci 1983). Due to the less than perfect preservation, the possibility that cuticle sculpting has been obfuscated and that the orientation of the claws may have been distorted during mounting, these specimens are only assigned no further than *Echiniscoides sigismundi sensu lato* (Schultze 1865).

Remarks. There are six subspecies currently recognised for *Echiniscoides sigismundi* with only *E. sigismundi polynesiensis* being recorded from the Southern Hemisphere. *E. sigismundi sensu lato*

has been recorded throughout the world but many of these records may now relate to newly described subspecies of *E. sigismundi* and further study is needed of live specimens from each of these locations to determine their identity. Unfortunately, cuticular sculptures which appear to be important in taxonomic investigations of this genus, gradually lose their refractive capabilities in the polyvinyl-lactophenol mountings commonly used in tardigrade study (Hallas & Kristensen 1982). The presence of two species of *Echiniscoides* from adjacent localities is not unusual. Hallas & Kristensen (1982) described two sympatric species of *Echiniscoides* from Narragansett, Rhode Island, North America. The collecting locality of Port Melbourne for *E. sigismundi polynesiensis* is some distance from the collecting locality of the *Echiniscoides* described in this paper.

DISCUSSION

Although there has been increasing interest in the study of marine tardigrades (Renaud-Mornant 1982) they remain largely unexplored in Australia. There is a direct correlation between the known distribution of marine tardigrades and that of tardigradologists (Villora-Moreno & Grimaldi De Zio 1996). With one of the most extensive coastlines and marine habitats available in the world, it is obvious that Australia remains a rich venue for research on these animals. The three tardigrades identified were found in their typical habitats. With the exception of the possible new species of *Batillipes*, the occurrence of these cosmopolitan species is not unexpected. Further investigation of live or freshly mounted specimens may provide the necessary information for more precise taxonomic assignments, particularly in the case of *Echiniscoides sigismundi*.

All three species show morphological adaptations to their microenvironments. Typical *Batillipes* have a strong strotaxis and ventrally flattened bodies, enabling them to move swiftly using their adhesive discs to keep in contact with the substrate (Grimaldi De Zio et al. 1983a). They are restricted to intertidal, interstitial environments. Archechiniscids use their clawed feet to attach themselves to coarse organogenic sediments or to anchor themselves to vegetation. *Echiniscoides* is often regarded as a facultative commensal of molluscs and cirripeds (Green 1950). Further investigation of the species diversity, distribution and relative abundance of marine tardigrades should be undertaken in order to clarify the role of these animals in the beaches and intertidal zones of Australia.

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